Notice No.2

Rules and Regulations for the Classification of Naval Ships, January 2017

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2017

Amendments to	Effective date	Mandatory Instrument
Volume 2, Part 1, Chapter 3, Section 15	1 July 2017	X
Volume 2, Part 2, Chapter 1, Section 2	Corrigenda	NA
Volume 2, Part 4, Chapter 2, Sections 2 & 3	1 July 2017	X
Volume 2, Part 4, Chapter 3, Sections 1, 2 & 4	1 July 2017	X
Volume 2, Part 4, Chapter 4, Sections 2, 5 & 6	1 July 2017	X
Volume 2, Part 6, Chapter 1, Sections 1, 4, 6, 7, 8 & 9	1 July 2017	X
Volume 2, Part 6, Chapter 1, Sections 6 & 7	Corrigenda	NA
Volume 2, Part 7, Chapter 3, Section 2	1 July 2017	X
Volume 2, Part 9, Chapter 3, Section 6	1 July 2017	NA
Volume 2, Part 9, Chapter 5, Section 4	1 July 2017	NA

Lloyd's Register

Working together
for a safer world

Volume 2, Part 1, Chapter 3
Requirements for Design, Construction, Installation and Sea Trials of Engineering Systems

■ *Section 15*
Podded propulsion units

15.1 Design

15.1.1 For details of design requirements, *see Vol 2, Pt 4, Ch 4 Podded Propulsion Units*.

The following requirements have been moved from Vol 2, Pt 4, Ch 4, Section 9.

~~9.1~~ 15.2 ~~General~~ Testing and trials

~~9.1.1~~ 15.2.1 The following requirements are to be complied with:

- *Vol 2, Pt 1, Ch 3, 16 Sea trials* for sea trials.
- *Vol 2, Pt 1, Ch 3, 15 Steering systems* for steering trials.

In addition, the functional capability specified in *Vol 2, Pt 4, Ch 4, 3.1 General 3.1.1* is to be demonstrated to the Surveyor's satisfaction.

~~9.1.2~~ 15.2.2 The actual values of steering torque are to be verified during sea trials to confirm that the design maximum dynamic duty torque has not been exceeded.

~~9.1.3~~ 15.2.3 Electric motor cooling systems are to be verified, as far as possible, to ensure that they are capable of limiting the extremes of ambient temperature to those specified in *Vol 2, Pt 4, Ch 4, 2.3 Pod internal atmospheric conditions 2.3.1*.

~~9.1.4~~ 15.2.4 Any trials and testing identified from the Risk Assessment report, *see Vol 2, Pt 1, Ch 3, 17 Risk Assessment (RA),* are also to be carried out.

Existing Sections Vol 2, Pt 1, Ch 3, 15 to 19 have been renumbered 16 to 20.

Volume 2, Part 2, Chapter 1
Reciprocating Internal Combustion Engines

■ *Section 2*
Documents required for design review

2.2 Submission requirements

Table 1.2.1 Plans and particulars to be submitted

Document	For information	For appraisal
	(x indicates reason for submission)	
Construction of accumulators ~~(common rail)~~ for electronically controlled engine		X
Construction of common accumulators ~~(common rail)~~ for electronically controlled engine		X

Volume 2, Part 4, Chapter 2
Water Jet Systems

■ *Section 2*
General requirements

2.2 Documentation required for design review

2.2.1 Plans~~, in triplicate,~~ and information as detailed below and in *Vol 2, Pt 4, Ch 2, 2.3 Calculations and information* and *Vol 2, Pt 4, Ch 2, 2.4 Risk Assessment (RA)*, are to be submitted for consideration.

2.2.5 The declared steering angle limits are to be stated by the manufacturer for each steerable water jet system.

■ *Section 3*
Design requirements

3.7 Nozzle/steering arrangements

3.7.1 ~~In general, the steering systems and components are to comply with the~~ The requirements of *Vol 2, Pt 6, Ch 1 Steering Gear* are to be complied with where applicable. ~~The requirements of *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3* and *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3* are addressed by *Vol 2, Pt 4, Ch 2, 3.7 Nozzle/steering arrangements 3.7.3* and the requirements of *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3* and *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3* are addressed by *Vol 2, Pt 4, Ch 2, 3.7 Nozzle/steering arrangements 3.7.4*.~~

3.7.2 Where more than one steerable water jet is fitted, *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2* is considered to be met when:

(a) Each steerable water jet fulfils the requirements for main steering gear (*see Vol 2, Pt 4, Ch 2, 3.7 Nozzle/Steering arrangements 3.7.3*), and

(b) Each steerable water jet is provided with the ability to position and lock the steerable water jet in a neutral position after a failure of its own power unit(s) and actuator(s). These arrangements are to be of sufficient strength to hold the steerable water jet in position at the ship's manoeuvring speed to be taken as not less than 7 knots. Operating instructions displayed at the locking mechanism's operating position are to include a direction to inform the bridge of any limitation in ship's speed required as a result of the securing mechanism being activated.

3.7.3 The main steering ~~arrangements are~~ gear is to be ~~operated by power and capable of changing the direction of the ship's water jet nozzles from one side to the other at declared steering angle limits, at an average rotational speed of not less than 0,4 rev/min with the ship running ahead at maximum ahead service speed.~~:

(a) Of adequate strength and capable of changing direction of the ship's steerable water jet from one side to the other in accordance with the declared steering angle limits at an average rotational speed of not less than 2,3 deg/s with the ship running ahead at maximum ahead service speed which shall be demonstrated in accordance with *Vol 2, Pt 1, Ch 3, 13.3 Testing*; and

(b) Operated by power; and

(c) So designed that they will not be damaged at maximum astern speed.

~~3.7.4 The auxiliary steering arrangements are to be:~~

~~3.7.5 Capable of changing the direction of the ship's water jet nozzles from one side to the other at declared steering angle limits at an average rotational speed of not less than 0,083 rev/min, with the ship running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater.~~

~~3.7.6 Operated by power for ships having propulsion power of more than 2500 kW per water jet unit and for all ships, where it is necessary, to meet the requirements of *Vol 2, Pt 4, Ch 2, 3.7 Nozzle/steering arrangements 3.7.5*.~~

3.7.4 The auxiliary steering gear is to be:

(a) Capable of being brought speedily into action in an emergency; and

(b) Of adequate strength and capable of changing the direction of the ship's water jet nozzles from one side to the other in accordance with the declared steering angle limits at an average rotational speed of not less than 0,5 deg/s, with the ship running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater.

(c) Operated by power for ships having propulsion power of more than 2500 kW per water jet unit and for all ships, where it is necessary to meet the requirements of *Vol 2, Pt 4, Ch 2, 3.7 Nozzle/steering arrangements 3.7.4(b)*.

~~3.7.2~~ 3.7.5 For vessels with more than one steerable water jet, ~~the requirement for~~ auxiliary steering ~~arrangements~~ gear ~~in *Vol 2, Pt 6, Ch 1 Steering Gear* is to be achieved by equipping each of the steerable water jets with its own dedicated and independent steering gear control system and power actuating system.~~ need not be fitted provided that each water jet unit is capable of being supplied by two identical power units (the steerable water jet may be supplied by shared or dedicated power units) and:

(a) Each water jet unit is capable of satisfying the requirements in *Vol 2, Pt 4, Ch 2, 3.7 Nozzle/steering arrangements 3.7.3(a)* while any one of the power units is out of operation; and

(b) Each of the steerable water jets is arranged so that after a single failure in its piping or in one of the power units, ship steering capability (but not individual steering system operation) can be maintained or speedily regained (e.g. by the possibility of positioning the failed steering system in a neutral position in an emergency, if needed).
Consideration will be given to alternative arrangements providing equivalence can be demonstrated.

Existing paragraphs 3.7.7 to 3.7.10 have been renumbered 3.7.6 to 3.7.9.

Volume 2, Part 4, Chapter 3
Thrusters

■ *Section 1*
General requirements

1.2 Redundancy

Existing paragraph 1.2.2 has been moved to become new paragraph 4.2.2.

~~1.2.2 For vessels with multiple azimuthing thrusters, the requirement for auxiliary steering arrangements in *Vol 2, Pt 6, Ch 1, 4 Performance* is to be achieved by equipping each of the azimuthing thrusters with its own dedicated and independent steering gear control system and power actuating system. Consideration will be given to alternative arrangements providing equivalence can be demonstrated.~~

Existing paragraph 1.2.3 has been renumbered 1.2.2.

■ *Section 2*
General requirements

2.1 Submission of information

2.1.1 ~~At least three copies of the~~ The following plans and information as detailed in *Vol 2, Pt 4, Ch 3, 2.2 Plans* and *Vol 2, Pt 4, Ch 3, 2.3 Calculations and specifications* are to be submitted.

2.3 Calculations and specifications

(*Part only shown*)
2.3.1 **Fixed/Azimuth propulsion thrusters** A System Design Description (*see Vol 2, Pt 1, Ch 3, 3.5 System design description*) containing the following:
(h) The declared steering angle limits are to be stated by manufacturer for each azimuth thruster.

■ *Section 4*
Design and construction

4.1 General

4.1.1 The arrangement of all types of thrusters is to be such that the craft can be manoeuvred in accordance with the design specifications. The operating conditions covered are to include the following:
(a) Maximum continuous shaft power/speed to the propeller in the ahead condition at the declared steering angles and conditions.
(b) Manoeuvring speeds of the propeller shaft and/or reversing mechanism in the ahead and astern direction at the declared steering angles and sea conditions.
(c) The stopping manoeuvre described in *Vol 2, Pt 1, Ch 3, 16.3 Performance testing 16.3.7.*
(d) Astern running conditions for the ship.

4.2 Azimuth thrusters

Existing paragraph 4.2.1 has been split into separate requirements and reordered to align with the content of the Ship and SSC Rules.

~~4.2.1 The following requirements are to be complied with:~~

~~(a)~~ 4.2.1 ~~In general, the steering systems and components are to comply with the~~ The requirements of *Vol 2, Pt 6, Ch 1 Steering Gear* are to be complied with where applicable. ~~The requirements of *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2* and *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2* are addressed by *Vol 2, Pt 4, Ch 3, 4.2 Azimuth thrusters 4.2.1* and the requirements of *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3* and *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3* are addressed by *Vol 2, Pt 4, Ch 3, 4.2 Azimuth thrusters 4.2.1*.~~

4.2.2 Where more than one azimuth thruster is fitted, *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2* is considered to be met when:

(a) Each azimuth thruster fulfils the requirements for main steering gear (*see Vol 2, Pt 4, Ch 3, 4.2 Azimuth thrusters 4.2.3*); and

(b) Each azimuth thruster is provided with the ability to position and lock the azimuth thruster in a neutral position after a failure of its own power unit(s) and actuator(s). These arrangements are to be of sufficient strength to hold the azimuth thruster in position at the ship's manoeuvring speed to be taken as not less than 7 knots. Operating instructions displayed at the locking mechanism's operating position are to include a direction to inform the bridge of any limitation in ship's speed required as a result of the securing mechanism being activated.

~~(c)~~ 4.2.3 The main steering ~~arrangements are~~ gear is to be ~~operated by power and capable of changing the direction of the ship's azimuth thrusters from one side to the other at declared steering angle limits, at an average rotational speed of not less than 0,4 rev/min with the ship running ahead at maximum ahead service speed.~~:

(a) Of adequate strength and capable of changing direction of the ship's azimuth thruster from one side to the other in accordance with the declared steering angle limits at an average rotational speed of not less than 2,3 deg/s with the ship running ahead at maximum ahead service speed which shall be demonstrated in accordance with *Vol 2*, *Pt 1, Ch 3, 14.2 Azimuth thrusters*;

(b) Operated by power; and

(c) So designed that they will not be damaged at maximum astern speed.

~~(d)~~4.2.4 The auxiliary steering ~~arrangements are~~ gear is to be:

(a) Capable of being brought speedily into action in an emergency; and

~~(i)~~ (b) Of adequate strength and ~~C~~capable of changing the direction of the ship's azimuth thrusters from one side to the other ~~at~~ in accordance with the declared steering angle limits at an average rotational speed of not less than ~~0,083 rev/min~~ 0,5 deg/s with the ship running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater~~.~~; and

~~(ii)~~ (c) Operated by power for ships having propulsion power of more than 2500 kW per thruster unit and for all ships, where it is necessary~~,~~ to meet the requirements of *Vol 2, Pt 4, Ch 3, 4.2 Azimuth thrusters* ~~*4.2.1*~~*4.2.4(b)*.

4.2.5 For vessels with more than one azimuth thruster, auxiliary steering gear need not be fitted provided that each azimuth thruster is capable of being supplied by two identical power units (the azimuth thruster may be supplied by shared or dedicated power units) and:

(a) Each azimuth thruster is capable of satisfying the requirements in *Vol 2, Pt 4, Ch 3, 4.2 Azimuth thrusters 4.2.3(a)* while any one of the power units is out of operation; and

(b) Each of the azimuth thrusters is arranged so that after a single failure in its piping or in one of the power units, ship steering capability (but not individual steering system operation) can be maintained or speedily regained (e.g. by the possibility of positioning the failed steering system in a neutral position in an emergency, if needed).

Consideration will be given to alternative arrangements providing equivalence can be demonstrated.

~~(b)~~ 4.2.6 The steering ~~arrangements~~ gear for azimuthing thrusters used for dynamic positioning applications with an associated class notation, ~~are~~ is to be capable of a maximum rotational speed of not less than ~~1,5 rev/min~~ 9 deg/s.

~~(e)~~4.2.7 Gearing for the azimuthing mechanism is to be designed to a recognised National Standard~~.~~ and the following conditions: ~~The design is to consider both static (<10^3 cycles) and dynamic loading conditions.~~

~~(f) Under dynamic operating conditions, the gear is to be considered for:~~

~~(i) design maximum dynamic duty steering torque;~~

~~(ii) variable loading, where applicable. A spectrum (duty) factor may be used. The load spectrum value is to be derived using load measurements of similar units, where possible.~~

- a design maximum dynamic duty steering torque;
- a static duty (≤103 load cycles) steering torque which should be not less than M_T, as defined in *Vol 2, Pt 4, Ch 3, 4.3 Azimuth thrusters with a nozzle 4.3.1*
- Variable loading, where applicable. A spectrum (duty) factor may be used. The load spectrum value is to be derived using load measurements of similar units, where possible.

~~(g)Under a static duty (<10^3 load cycles) steering torque, which should be not less than M_T, as defined in *Vol 2, Pt 4, Ch 3, 4.3 Azimuth thrusters with a nozzle 4.3.1*~~

~~(h)~~4.2.8 The following minimum factor of safety values are to be achieved:
Surface Stress $S_{Hmin} = 1,0$.
Bending Stress $S_{Fmin} = 1,5$.

~~(i)~~4.2.9 For hydraulic pressure retaining parts and load bearing components, *see also Vol 2, Pt 6, Ch 1 Steering Gear*.

Volume 2, Part 4, Chapter 4
Podded Propulsion Units

■ *Section 2*
General requirements

2.2 Documentation required for design review

(*Part only shown*)

2.2.1 In addition to the plans required by *Vol 2, Pt 3, Ch 1 Gearing* and *Vol 2, Pt 3, Ch 2 Shafting Systems*, *Vol 2, Pt 4, Ch 1 Propellers, Vol 2, Pt 5 Shaft Vibration and Alignment, Vol 2, Pt 6, Ch 1 Steering Gear, Vol 2, Pt 7, Ch 3 Machinery Piping Systems* and *Vol 2, Pt 9 Electrotechnical Systems* and *Vol 2, Pt 10 Human Factors*, the following plans and information are required to be submitted for appraisal. Where appropriate, the information shall be contained in a System Design Description document, *see Vol 2, Pt 1, Ch 3, 3.5 System design description*:

(b) The declared steering angle limits are to be stated by the steering system manufacturer for each podded propulsion unit;

Ordered listed items (b) to (y) have been renumbered (c) to (z).

Existing Section 3 has been deleted in its entirety, contents have been moved to existing sub-Section 6.6 (new 5.6) as shown below.

Existing Sections 4 and 5 have been renumbered 3 and 4.

■ *Section ~~6~~ 5*
Machinery design and construction requirements

Existing sub-Sections 6.1 to 6.5 have been renumbered 5.1 to 5.5.

~~6.6~~ 5.6 Steering system

~~6.6.1~~ 5.6.1 The requirements of Vol 2, *Pt 6, Ch 1 Steering Gear*~~, Sections Vol 2, Pt 6, Ch 1, 1 General requirements, Vol 2, Pt 6, Ch 1, 2 Documentation required for design review, Vol 2, Pt 6, Ch 1, 3 Materials, Vol 2, Pt 6, Ch 1, 4 Performance, Vol 2, Pt 6, Ch 1, 5 Design and construction, Vol 2, Pt 6, Ch 1, 8 Monitoring and alarms and~~ ~~*Vol 2, Pt 6, Ch 1, 9 Alternative sources of power and emergency operation*~~ are to be complied with where applicable. ~~*See also* Vol 2, Pt 4, Ch 4, 3.1 General. The requirements of~~ ~~*Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2*~~ ~~and~~ ~~*Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2*~~ ~~are addressed by~~ ~~*Vol 2, Pt 4, Ch 4, 3.1 General 3.1.2*~~ ~~and the requirements of~~ ~~*Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3*~~ ~~and~~ ~~*Vol 2, Pt 6, Ch 1, 4.1 General 4.1.3*~~ ~~are addressed by~~ ~~*Vol 2, Pt 4, Ch 4, 3.1 General 3.1.3.*~~

~~3.1.1~~ 5.6.2 The arrangement of podded propulsion units is to be such that the ship can be satisfactorily manoeuvred to a declared performance capability. The operating conditions covered are to include the following:

(a) Maximum continuous shaft power/speed to the propeller in the ahead condition at the declared steering angles and sea conditions.
(b) Manoeuvring speeds of the propeller shaft in the ahead and astern direction at the declared steering angles and sea conditions.
(c) The stopping manoeuvre described in *Vol 2, Pt 1,* ~~*Ch 2 Requirements for Machinery and Engineering Systems of Unconventional Design*~~ *Ch 3, 16.3 Performance testing*.
(d) All astern running conditions for the ship.
(e) Manoeuvring in ice where ice class is required.

5.6.3 Where more than one podded propulsion unit is fitted, *Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2* is considered to be met when:

(a) Each podded propulsion unit fulfils the requirements for main steering gear (*see Vol 2, Pt 4, Ch 4, 5.6 Steering system 5.6.4*); and
(b) Each podded propulsion unit is provided the ability to position and lock the podded propulsion unit in a neutral position after a failure of its own power unit(s) and actuator(s). These arrangements are to be of sufficient strength to hold the podded propulsion unit in position at the ship's manoeuvring speed to be taken as not less than 7 knots, *see also Vol 2, Pt 4, Ch 4, 5.3 Propulsion shafting 5.3.11*. Operating instructions displayed at the locking mechanism's operating position are to include a direction to inform the bridge of any limitation in ship's speed required as a result of the securing mechanism being activated.

~~3.1.2~~ 5.6.4 The main steering ~~arrangements are~~ gear is to be ~~operated by power and capable of changing the direction of the ship's podded propulsion units from one side to the other at declared steering angle limits at an average rotational speed of not less than 0,4 rev/min with the ship initially operating at its maximum ahead service speed.~~:

(a) Of adequate strength and capable of changing direction of the podded propulsion unit from one side to the other in accordance with the declared steering angle limits at an average rotational speed of not less than 2,3 deg/s with the ship running ahead at maximum ahead service speed which shall be demonstrated in accordance with *Vol 2, Pt 1, Ch 3, 15.2Testing and trials* and *Vol 2, Pt 1, Ch 3, 16.3 Performance testing*; and
(b) Operated by power; and

(c) So designed that they will not be damaged at maximum astern speed.

~~3.1.3~~ 5.6.5 The auxiliary steering ~~arrangements are~~ gear is to be:

(a) Capable of being brought speedily into action in an emergency; and

~~(a)~~(b) Of adequate strength and ~~C~~capable of changing the direction of the ship's podded propulsion units from one side to the other ~~at~~ in accordance with the declared steering angle limits at an average rotational speed of not less than ~~0,083 rev/min~~ 0,5 deg/s, with the ship running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater~~.~~; and

~~(b)~~(c) Operated by power for ships having propulsion power of more than 2500 kW per podded propulsion unit and for all ships, where it is necessary~~,~~ to meet the requirements of ~~*Vol 2, Pt 4, Ch 4, 3.1 General 3.1.3*~~ *Vol 2, Pt 4, Ch 9, 5.6 Steering system 5.6.5(b)*.

~~6.6.3~~ 5.6.6 For vessels with more than one ~~steerable~~ podded propulsion unit, ~~the requirement for~~ auxiliary steering ~~arrangements~~ gear ~~in *Vol 2, Pt 6, Ch 1, 4 Performance* is to be achieved by equipping each of the podded propulsion units with its own dedicated and independent steering gear control system and power actuating system.~~ need not be fitted provided that each podded propulsion unit is capable of being supplied by two identical power units (the podded propulsion unit may be supplied by shared or dedicated power units) and:

(a) Each podded propulsion unit is capable of satisfying the requirements of *Vol 2, Pt 4, Ch 4, 5.6 Steering system 5.6.4(a)* while any one of the power units is out of operation; and

(b) Each of the podded propulsion units is arranged so that after a single failure in its piping or in one of the power units, ship steering capability (but not individual steering system operation) can be maintained or speedily regained (e.g. by the possibility of positioning the failed steering system in a neutral position in an emergency, if needed). Consideration will be given to alternative arrangements providing equivalence can be demonstrated.

~~6.6.2 For vessels where a single podded propulsion unit is the sole means of propulsion, the requirement for auxiliary steering arrangements in *Vol 2, Pt 6, Ch 1, 4 Performance* is to be achieved by means of two or more identical power units.~~

5.6.7 The steering gear for podded units used for dynamic positioning applications with an associated class notation, is to be capable of a rotational speed of not less than 9 deg/s.

Existing paragraph 6.6.4 has been renumbered 5.6.8.

~~6.6.5 The steering mechanism is to be provided with power that is sufficient for the maximum steering torques present during the declared functional capability identified in *Vol 2, Pt 4, Ch 4, 3.1 Genera*and is to be demonstrated for the most onerous specified manoeuvring trial, *see Vol 2, Pt 4, Ch 4, 9 Testing and trials*.~~

Existing paragraphs 6.6.6 to 6.6.8 have been renumbered 5.6.9 to 5.6.11.

~~6.6.9 On multi podded ships, means are to be provided to secure each pod unit's slewing mechanism in its mid position in the event of a steering system failure. These arrangements are to be of sufficient strength to hold the pod in position at the ship's manoeuvring speed to be taken as not less than 7 knots, *see also Vol 2, Pt 4, Ch 4, 6.3 Propulsion shafting 6.3.9*. Operating instructions displayed at the securing mechanism's operating position are to include a direction to inform the bridge of any limitation in ship's speed required as a result of the securing mechanism being activated.~~

Existing sub-Sections 6.7 to 6.9 have been renumbered 5.7 to 5.9.

Existing Sections 7 and 8 have been renumbered 6 and 7.

Existing Section 9 has been deleted in its entirety and the content of sub-section 9.1 General moved to form a new Section in Vol 2, Pt 1, Ch 3, Section 15 as shown above.

Existing Section 10 has been renumbered Section 8.

Volume 2, Part 6, Chapter 1
Steering Gear

■ *Section 1*
General requirements

1.2 Definitions

1.2.9 ~~**Steering arrangements** means the complete system of components for providing ship directional control.~~ **Steering system** means a complete system of sub-systems and equipment necessary to steer the ship including: the rudder (or podded propulsion unit, azimuth thruster, steerable water jet as applicable), main steering gear, auxiliary steering gear and steering gear control system.

~~1.2.10 **Directional control system** means the equipment used to effect changes in ship direction e.g. the rudder, podded propulsion unit, azimuth thrusters or water jet nozzle. Note that for podded propulsion systems, azimuth thrusters, water jet systems, or other similar systems for effecting changes in ship direction, it is to be assumed that the units must provide thrust in addition to rotation and hence the directional control system must include the propulsion system.~~

1.2.10 **Declared steering angle limits** are the operational limits in terms of maximum steering angle, or equivalent, according to manufacturer’s guidelines for safe operation, also taking into account the vessel’s speed or propeller torque/speed or other limitation; ship's manoeuvring characteristics required by **LMA** or **LMNA** notations are to be carried out with steering angles not exceeding the declared steering angle limits.

■ *Section 4*
Performance

4.1 General

4.1.1 Main and auxiliary steering gear for rudder-type steering systems are to meet the performance requirements in *Vol 2, Pt 6, Ch 1, 4.2 Performance requirements for rudder-type steering systems*. Steering performance on ships fitted with podded propulsion systems is to comply with *Vol 2, Pt 4, Ch 4, 5.6 Steering system* in addition to the requirements of this Chapter, as applicable. Steering performance on ships fitted with steerable water jet systems is to comply with *Vol 2, Pt 4, Ch 2, 3.7 Nozzle/steering arrangements* in addition to the requirements of this Chapter, as applicable. Steering performance on ships fitted with azimuth thruster systems is to comply with *Vol 2, Pt 4, Ch 3, 4.2 Azimuth thrusters* in addition to the requirements of this Chapter, as applicable.

Existing paragraph 4.1.1 has been renumbered 4.1.2.

Existing paragraphs 4.1.2 to 4.1.4 have been moved to new sub-Section 4.2.

Existing paragraphs 4.1.5 to 4.1.9 have been renumbered 4.1.3 to 4.1.7.

4.2 Performance requirements for rudder-type steering systems

~~4.1.2~~ 4.2.1 The main steering ~~arrangements for ship directional control are~~ gear is to be:
(a) Of adequate strength and capable of ~~steering the ship at maximum ahead service speed which shall be demonstrated in accordance with *Vol 2, Pt 1, Ch 3, 15.4 Testing 15.4.2*;~~
~~(b) Capable of putting~~ Putting the rudder over from 35° on one side to 35° on the other side with the ship at its deepest sea-going draught and running ahead at maximum ahead service speed and under the same conditions, from 35° on either side to 30° on the other side in not more than 28 seconds which shall be demonstrated in accordance with *Vol 2, Pt 1, Ch 3, 15.4 Testing 15.4.*; and
~~(c)~~ (b) Operated by power where necessary to meet the requirements of *Vol 2, Pt 6, Ch 1, 4.2 Performance requirements for rudder-type steering systems 4.2.1(a)* and in any case when the Rules excluding strengthening for navigation in ice, require a rudder stock over 120 mm diameter in way of the tiller; and
~~(d)~~ (c) So designed that they will not be damaged at maximum astern speed; however, this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

~~4.1.3~~ 4.2.2 The auxiliary steering ~~arrangements for ship directional control are~~ gear is to be:
(a) ~~Of adequate strength and c~~Capable of steering the ship at navigable speed and of being brought speedily into action in an emergency; and
(b) Of adequate strength and ~~C~~capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 seconds with the ship at its deepest sea-going draught and running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater; and
(c) Operated by power where necessary to meet the requirements of *Vol 2, Pt 6, Ch 1, 4.2 Performance requirements for rudder-type steering systems 4.2.2(b)* and in any case when the Rules, excluding strengthening for navigation in ice, require a rudder stock over 230 mm diameter in way of the tiller.

~~4.1.4~~ 4.2.3 Where the main steering ~~arrangements for ship directional control~~ gear comprises two or more identical power units, auxiliary steering arrangements need not be fitted, provided that:

(a) the main steering ~~arrangements are~~ gear is capable of operating the ~~ship's directional control system~~ rudder as required by ~~*Vol 2, Pt 6, Ch 1, 4.1 General 4.1.2*~~ *Vol 2, Pt 6, 4.2 Performance requirements for rudder-type steering systems 4.2.1(a)* while any one of the power units is out of operation~~.~~; and

(b) The main steering gear is arranged so that after a single failure in its piping system or in one of the power units the defect can be isolated so that steering capability can be maintained or speedily regained.

Sub-Section 4.2 has been renumbered 4.3.

■ *Section 6*
Steering control systems

6.1 General

6.1.1 The steering control system is to comply with *Vol 2, Pt 9, Ch 7 Control, Alerts and Safety Systems*.

Existing paragraphs 6.1.1 to 6.1.4 have been renumbered 6.1.2 to 6.1.5.

~~6.1.5~~ 6.1.6 Arrangements for failure detection are to be provided with self-monitoring capabilities. In the event of failure being detected, an audible and individual visual alarm is to be initiated on the navigating bridge. *See Vol 2, Pt 6, Ch 1, 8.1 Monitoring and alarms*. Where the system failure alarms for hydraulic lock (*see Table 1.8.1 Alarms*) are provided, appropriate instructions ~~shall~~ are to be placed on the navigating bridge to shut down the system at fault.

6.1.7 In the event of detecting a control system failure, which is likely to cause uncontrolled rudder movements, *see Table 1.8.1 Alarms*, the rudder is to retain its position at the time of failure. Alternatively, consideration will be given to the rudder moving to and retaining a position which is necessary for safe navigation of the vessel or to return to the mid-ship position where technical justification is submitted and is found to be satisfactory.

■ *Section 7*
Electrical power circuits and equipment

7.1 Electric power circuits, electric control circuits, monitoring and alarms

7.1.1 In addition to this section, the electrical installation is to comply with the relevant sections of *Vol 2, Pt 9 Electrotechnical Systems*.

Existing paragraphs 7.1.1 to 7.1.11 have been renumbered 7.1.2 to 7.1.12.

7.1.13 For a ship fitted with multiple steering systems, *Vol 2, Pt 6, Ch 1, 7.1 Electric power circuits, electric control circuits, monitoring and alarms 7.1.6* to *Vol 2, Pt 6, Ch 1, 7.1 Electric power circuits, electric control circuits, monitoring and alarms 7.1.10* are to be applied to each of the steering systems.

■ *Section 8*

Monitoring and alarms

8.1 Monitoring and alarms

Table 1.8.1 Alarms

Item	Alarm	Note
Angular position of the steering mechanism	—	Indication, *see Vol 2, Pt 6, Ch 1, 8.1 Monitoring and alarms 8.1.2*
	Failure	*See Vol 2, Pt 6, Ch 1, 8.1 Monitoring and alarms 8.1.4*
Earthing on AC and DC circuits	Fault	If galvanically isolated from the ship’s network
Data communication	Error	Where the data deviates from expected value, sequence or timing
Steering power units, power	Failure	—
Steering motors	Overload Single phase	For alarm and running indication locations, *see Vol 2, Pt 6, Ch 1, 7.1 Electric power circuits, electric control circuits, monitoring and alarms 7.1.3* and *Vol 2, Pt 6, Ch 1, 7.1 Electric power circuits, electric control circuits, monitoring and alarms 7.1.4*
Control system	Failure	*See Vol 2, Pt 6, Ch 1, 8.1 Monitoring 8.1.4*
Control system power	Failure	—
Steering gear hydraulic oil tank level	Low	Each reservoir to be monitored. For alarm locations, *see Vol 2, Pt 6, Ch 1, 7.1 Electric power circuits, electric control circuits, monitoring and alarms*
Auto pilot	Failure	Running indication
Hydraulic oil temperature	High	Where oil cooler is fitted
Hydraulic lock	Fault	Where more than one system (either power or control) can be operated simultaneously each system is to be monitored, *see* Note 1
Hydraulic oil filter differential pressure	High	When oil filters are fitted
~~Control system~~	~~Failure~~	~~*See Vol 2, Pt 6, Ch 1, 8.1 Monitoring 8.1.4*~~

NOTE

1. This alarm is to identify the system at fault and to be activated when (for example):

- Position of the variable displacement pump control system does not correspond with given order; or
- incorrect position of 3-way full flow valve or similar in constant delivery pump system is detected.

■ *Section 9*
Alternative sources of power and emergency operation

9.1 Alternative sources of power

9.1.1 Where specified and agreed by the Naval Administration, in a NS3 category ship, the requirements of *Vol 2, Pt 6, Ch 1, 9.1 Alternative sources of power* may not be required for those ships not fitted with an emergency generator or equivalent arrangements.

Existing paragraphs 9.1.1 to 9.1.3 have been renumbered 9.1.2 to 9.1.4.

Volume 2, Part 7, Chapter 3
Machinery Piping Systems

■ *Section 2*
Fuel oil – General requirements

2.3 Fuel oil sampling

2.3.1 Sampling points are to be provided ~~at locations~~ within the fuel oil system. The design and location of sampling points is to ~~that~~ enable samples of fuel oil to be taken easily and in a safe manner.

2.3.2 The position of a sampling point is to be such that the sample of the fuel oil is representative of the fuel oil quality at ~~that~~ its location within the system, e.g. by ensuring steady state flow past the sampling point.

Note Samples taken from sounding pipes and tank drain cocks are not considered to be representative of the tank's contents.

2.3.3 Sampling points are to be located so as to reduce the possibility of fuel oil coming into contact with any heated surface or electrical equipment under reasonably foreseeable operating conditions and therefore shall be positioned as far away as possible from such surfaces or equipment. Where contact is still likely, positions are to be shielded from any heated surface or electrical equipment. The shielding shall be sturdy enough to endure leaks, splashes or spray under design pressure of the fuel oil supply line.

2.3.4 A sampling point or points shall be provided:

(a) Taking into account different fuel oil grades being used for the fuel oil combustion machinery item;
(b) Downstream of the in-use fuel oil service tank; and
(c) As close to the fuel oil combustion machinery as safely feasible taking into account the type of fuel oil, flow-rate, temperature, and pressure behind the selected sampling point.

~~2.3.3~~ 2.3.5 The sampling arrangements within the machinery space are to be capable of safely providing samples when the machinery is running and are to be provided with isolating valves and cocks of the self-closing type. ~~The sampling points are to be located in positions as far removed as possible from any heated surface or electrical equipment so as to preclude impingement of fuel oil onto such surfaces on equipment under all operating conditions, see *Vol 2, Pt 1, Ch 3, 4.6 Inclination of ship*.~~

Volume 2, Part 9, Chapter 3
Electrical Power Distribution and Equipment

■ *Section 6*
Rotating machines – general requirements and motors

6.1 General requirements

~~6.1.11 For high voltage machines, the stator insulation system is to be of a type that has undergone sample testing in accordance with the following International Standards, or relevant alternatives acceptable to LR, to demonstrate its suitability for the operating voltage in the presence of an LR Surveyor:~~

~~(a) *IEC 60034-27-3, Dielectric dissipation factor measurement on stator winding insulation of rotating electrical machines;* and~~
~~(b) *IEC 60034-15, Impulse Voltage Withstand Levels of Form-wound Stator Coils for Rotating a.c. Machines, with power-frequency voltage withstand testing conducted*.~~

~~Test samples are to be representative in terms of the number and size of conductors, coil construction, combination of materials and manufacturing process~~

~~6.1.12 For testing required by *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.10* on coils relating to global vacuum pressure impregnated systems, test samples representing the unimpregnated state and the impregnated state of the final winding and stator core are to be used as appropriate for testing.~~

6.1.11 For high voltage machines, the stator insulation system is to be of a type that has undergone type testing in accordance with the following International Standards, or relevant alternatives acceptable to LR, to demonstrate its suitability for the operating voltage:

(a) IEC 60034-18-31 *Rotating electrical machines – Part 18-31: Functional evaluation of insulation systems – Test procedures for form-wound windings – Thermal evaluation and classification of insulation systems used in rotating machines*;
(b) IEC 60034-18-32 *Rotating electrical machines – Part 18-32: Functional evaluation of insulation systems – Test procedures for form-wound windings – Evaluation by electrical endurance;*
(c) IEC TS 60034-18-33 *Rotating electrical machines – Part 18-33: Functional evaluation of insulation systems – Test procedures for form-wound windings – Multifactor evaluation by endurance under simultaneous thermal and electrical stresses;*
(d) IEC 60034-18-34 *Rotating electrical machines – Part 18-34: Functional evaluation of insulation systems – Test procedures for form-wound windings – Evaluation of thermomechanical endurance of insulation systems;*
(e) IEC 60034-27-3, *Dielectric dissipation factor measurement on stator winding insulation of rotating electrical machines.*

Test samples are to be representative in terms of the number and size of conductors, coil construction, and the combination of materials and manufacturing process.

6.1.12 The reference insulation system, against which the test samples in *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.11* are to be validated, is to have demonstrated to be suitable for use in the environmental conditions that the finished machine will be exposed to in service. Documented evidence of such suitability is to be available to the LR Surveyor, at the time these tests are conducted.

6.1.13 Sample coils for use in the machines detailed in *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.11* are to be type tested and subsequently routinely tested in accordance with the following International Standards, or relevant alternatives acceptable to LR. The interval between routine tests is to be agreed with LR, and testing is to be witnessed by an LR Surveyor:

(a) IEC TR 60894, *Guide for test procedure for the measurement of loss tangent of coils and bars for machine windings*, at ambient temperature; and
(b) IEC 60034-15: *Rotating electrical machines – Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines*, with power-frequency voltage withstand testing conducted.

Test samples are to be representative in terms of the number and size of conductors, coil construction, and the combination of materials and manufacturing process.

6.1.14 For coils manufactured using global vacuum pressure impregnated systems, the test samples required in *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.11* and *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.13* are to be:

(a) in their finished, impregnated state;
(b) manufactured in accordance with documented production quality control processes and procedures.

6.1.15 Converter-fed high voltage rotating machines intended for Ship Type and Mobility systems are to be designed for the in-service operating conditions originating from the converter. These are to include as a minimum, but are not limited to:

(a) maximum peak voltage and rise times;
(b) maximum voltage gradient;
(c) pulse repetition rate;
(d) voltage reflections; and
(e) fault conditions.

6.1.16 The insulation system of the high voltage machine referred to in *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.15* is to be type tested and its suitability verified for use with the converter.

6.1.17 Converter fed low voltage propulsion motors are to have their insulation systems comply with *Vol 2, Pt 9, Ch 3, 6.1 General requirements 6.1.15* where the waveforms are non-sinusoidal or transients may exceed 1kV.

Volume 2, Part 9, Chapter 5
Hazardous Areas

■ *Section 4*
Electrical equipment for use in explosive gas atmospheres or in the presence of combustible dusts

4.1 General

4.1.1 The installation of electrical equipment in spaces and locations in which flammable mixtures are liable to collect, e.g. areas containing flammable gas or vapour and/or combustible dust, is to be minimised~~ as far as is consistent with operational necessity and the provision of lighting, monitoring, alarm or control facilities enhancing the overall safety of the ship~~.

4.1.2 In order to eliminate potential sources of ignition from spaces and locations in which flammable mixtures are liable to collect, such ~~dangerous or~~ hazardous areas are to be identified and electrical equipment within these areas is to be selected and installed in accordance with the requirements of this Section.

4.1.3 Spaces and locations are considered as hazardous on the presence of any of the following:

(a) spaces or tanks containing either:
  (i) flammable liquid having a flashpoint (closed-cup test) not exceeding 60°C and below;
  (ii) flammable liquid having a flashpoint exceeding 60°C, heated or raised by ambient conditions to a temperature within 15°C of its flashpoint; or
  (iii) flammable gas;
(b) piping systems or equipment containing fluid defined by (a) and having flanged joints or glands or other openings through which leakage of fluid may occur under normal operating conditions;
(c) spaces containing solids liable to release flammable gas and/or combustible dust;
(d) spaces containing dangerous goods in packaged form, of the following Classes as defined in the IMDG Code: 1 (with the exception of goods in division 1.4, compatibility group S), 2.1 (inclusive of applicable gas bottles for on board use), 3, 6.1 and 8;
(e) piping systems or equipment associated with processes (such as electro-chlorination) generating flammable gas as a by-product and having openings from which the gas may escape under normal operating conditions; or
(f) piping systems or equivalent containing flammable liquids not defined by (a), having flanged joints, glands or other openings through which leakage of fluid in the form of a mist or fine spray may occur under normal operating conditions.

4.1.4 Equipment that is to be installed in an area where explosive gases can be present is to be selected in accordance with *Vol 2, Pt 9, Ch 5, 4.3 Selection of equipment for use in explosive gas atmospheres*.

4.1.5 Equipment that is to be installed in an area where combustible dusts can be present is to be selected in accordance with *Vol 2, Pt 9, Ch 5, 4.4 Selection of equipment for use in the presence of combustible dusts*.

~~4.1. 3~~ 4.1.6 Electrical installations in magazines, are to be in accordance with *Vol 1, Pt 4, Ch 1, 6.8 Piping, cabling and electrical systems.*

~~4.1.4 Equipment that is to be installed in an area where both explosive gases and combustible dusts can be present is to be selected in accordance with both *Vol 2, Pt 9, Ch 5, 4.2 Selection of equipment for use in explosive gas atmospheres* and *Vol 2, Pt 9, Ch 5, 4.3 Selection of equipment for use in the presence of combustible dusts*.~~

~~4.1.5~~ 4.1.7 For permanent secondary battery installations, *see Vol 2, Pt 9, Ch 2, 7 Batteries*.

4.2 Hazardous areas

4.2.1 For hazardous areas and sources of hazards for naval ships, the following principles are to apply in general.

4.2.2 Hazardous areas associated with flammable liquids or gases are classified into zones based upon the frequency of the occurrence and duration of an explosive gas atmosphere, as follows:

- **zone 0**: an area in which an explosive atmosphere is present continuously or for long periods or frequently,
- **zone 1**: an area in which an explosive atmosphere is likely to occur periodically or occasionally in normal operation,
- **zone 2**: an area in which an explosive atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only. *See* IEC 60079-101-1: *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*.

4.2.3 Hazardous areas associated with solid substances or packaged liquids to which *Vol 2, Pt 9, Ch 5, 4.12 Special requirements for ships intended for the carriage of dangerous goods and materials hazardous only in bulk* applies are classified into zones based upon the frequency of the occurrence and duration of an explosive atmosphere due to the presence of gas and/or combustible dust, as follows:
• **hazardous area**: area in which an explosive atmosphere is likely to occur in normal operation (comparable with **zone 1**),
• **extended hazardous area**: area in which an explosive atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only (comparable with **zone 2**).
See IEC 60092-506: Electrical Installation in ships-Part 506 – Special features – Ships carrying specific dangerous goods and materials hazardous only in bulk. An explosive atmosphere may exist due to gas and/or combustible dust.

4.2.4 The following areas are regarded as hazardous, **zone 0**:
(a) the interiors of those spaces, tanks, piping systems and equipment defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(a)* and *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3 (b)*; and
(b) enclosed, unventilated spaces containing pipework or equipment defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(b)* and *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(e)*.

4.2.5 The following areas are regarded as hazardous, **zone 1**:
(a) the interiors of spaces containing dangerous goods as defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(d)*;
(b) unventilated spaces separated by a single bulkhead or deck from a cargo defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(a)*;
(c) ventilated spaces containing pipework or equipment defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(b)* and *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(e);*
(d) zones within a 3 m radius of ventilation outlets, hatches or doorways or other openings into spaces defined by *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(a)*, *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(b)* or *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(c);*
(e) zones on open deck within 3 m of the ventilation outlets of tanks defined in *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(a)*, which permit the flow of small volumes of vapour or gas mixtures caused by thermal variation;
(f) zones within a 3 m radius of flanged joints, or glands or other openings defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(b)*;
(g) zones within a 1,5 m radius of flanged joints, or glands or other openings defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(e) and Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(f)*;
(h) zones within a 3 m radius of bunds or barriers intended to contain spillage of liquids defined by *Vol 2, Pt 9, Ch 5, 4.1 General 4.1.3(a)*;
(i) zones on open deck within a 1,5 m radius of any opening into a space defined by *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(b)*;
(j) enclosed or semi-enclosed spaces with direct opening into a **zone 1** hazardous location;
(k) zones within a 1,5 m radius of ventilation inlets or other openings serving spaces defined by *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(c)*; and
(l) zones on open deck within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet which permit the flow of large volumes of vapour or gas mixtures during loading/discharging/ballasting.

4.2.6 The following zones or spaces are regarded as hazardous, **zone 2**:
(a) ventilated spaces separated by a single bulkhead or deck from a **zone 0** space;
(b) zones on open deck extending 1,5 m beyond those defined by *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(d)*, *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(f)*, *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(g)*, *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(h)* or *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(i)*;
(c) zones on open deck extending 2 m beyond those defined by *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(e)*;
(d) zones on open deck extending 4 m beyond those defined by *Vol 2, Pt 9, Ch 5, 4.2 Hazardous areas 4.2.5(l)*; and
(e) enclosed or semi-enclosed spaces with direct opening into a **zone 2** hazardous location.

~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres

~~4.2.1~~ 4.3.1 When equipment is to be installed in areas where an explosive gas atmosphere may be present it is generally to be of a type providing protection against ignition of the gases encountered and compliant with the relevant Parts of IEC 60079: *Explosive atmospheres*, an agreed specified standard where applicable, *see Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.4~~ 4.3.4*, *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.5~~ 4.3.5* or *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.6~~ 4.3.6*.

~~4.2.2~~ 4.3.2 The equipment protection type permitted depends on the hazardous ~~zone~~ area where the equipment is to be located, as defined in *Vol 2, Pt 9, Ch 5, ~~4.5~~ 4.2 Hazardous ~~zones and spaces~~ areas*. For certain locations on the ship other requirements may limit installations to specific equipment types and/or particular applications.

~~4.2.3~~ 4.3.3 Equipment for **zone 0** or **zone 1**, with the exception of simple apparatus as defined in *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.4~~ 4.3.4* or *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.5~~ 4.3.5*, is to be certified or approved by a National or other appropriate Authority. Equipment without independent certification or approval may be considered for installation in **zone 2**.

~~4.2.4~~ 4.3.4 In **zone 0**, the following may be considered:
(a) intrinsically safe, category ‘a’ (Ex ‘ia’); or
(b) simple electrical apparatus and components (for example, thermocouples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically safe circuits of category ‘ia’, ~~not capable of storing or generating electrical power or energy in excess of the limits given in~~ compliant with IEC 60079-14: *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*.

~~4.2.5~~ 4.3.5 In **zone 1**, the following may be considered:
(a) ~~apparatus~~equipment permitted within **zone 0**;
(b) intrinsically safe, category ‘b’ (Ex ‘ib’);
(c) simple apparatus as defined above, included in intrinsically safe circuits of category ‘ib’;
(d) increased safety (Ex ‘e’);
(e) flameproof (Ex ‘d’);
(f) pressurised enclosure (Ex ‘p’);
(g) powder filled (Ex ‘q’); or
(h) encapsulated (Ex ‘m’); and
(i) Special – Ex ‘s’, where permitted by the equipment certification.

~~4.2.6~~ 4.3.6 In **zone 2**, the following may be considered:
(a) equipment ~~apparatus~~ permitted within ~~**zone 0**~~ ~~or~~ **zone 1**;
(b) type of protection ‘n’ or ‘N’;
(c) equipment such as control panels, protected by purging and pressurisation and capable of being verified by inspection as meeting the requirements of IEC 60079-2: *Explosive atmospheres – Part 2: Equipment protection by pressurized enclosures "p"*; ~~or~~ and
(d) radio aerials having robust construction, meeting the relevant requirements of IEC 60079-15: *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*. Additionally, in the case of transmitter aerials, it is to be shown, by detailed study or measurement, or by limiting the peak radiated power and field strength to 1 W and 30 V/m, respectively, that they present negligible risk of inducing incendive sparking in adjacent structures or equipment.

~~4.2.7~~ 4.3.7 ~~Apparatus~~ Equipment having type of protection ‘ia’, ‘ib’, or ‘d’, is to be of a Group (IIA, IIB or IIC) meeting or exceeding that required for safe operation in the presence of any gas or vapour that can be present, or is to be certified specifically for such gases or vapours.

~~4.2.8~~ 4.3.8 All ~~apparatus~~ equipment is to be of a temperature classification (T1 to T6) that confirms, or is to be assessed so as to confirm, that its maximum surface temperature will not reach the ignition temperature of any gas or vapour, or mixture of gases or vapours, which can be present. The surface temperature considered may be that of an internal or external part, according to the type of protection of the ~~apparatus~~ equipment.

~~4.3~~ 4.4 Selection of equipment for use in the presence of combustible dusts

4.~~3~~.1 4.3.1 Where ~~apparatus~~ equipment is to be installed in **hazardous areas**, as defined by *Vol 2, Pt 9, Ch 5, ~~4.5~~ 4.2 Hazardous areas ~~zones and spaces~~ ~~4.5.3~~ 4.2.3*, associated with the presence of combustible dusts, it is~~, when practicable,~~ to be of a type certified ~~or approved~~ by a National or other appropriate Authority for the combustible dusts and, additionally, any explosive gases encountered.

~~4.3.2~~ 4.4.2 Electrical equipment for use in ~~such~~ **hazardous areas** is to be so designed and installed as to minimise the accumulation of combustible dust which may interfere with the safe dissipation of heat from the enclosure.

~~4.3.3~~ 4.4.3 Where ~~apparatus~~ equipment is to be installed in **extended hazardous areas**, as defined by *Vol 2, Pt 9, Ch 5, ~~4.5~~ 4.2 Hazardous ~~zones and spaces~~ areas ~~4.5.3~~ 4.2.3*, associated with the presence of combustible dust and, additionally, any explosive gases encountered, the following may be considered:
(a) ~~apparatus~~ equipment permitted within a ~~hazardous area~~ **hazardous area** ~~associated with the combustible dust(s) that can be present~~ as defined by *Vol 2, Pt 9, Ch 5, 4.4 Selection of equipment for use in the presence of combustible dusts 4.4.1*;
(b) ~~apparatus~~ equipment having degree of protection IP5X, or better, and having a surface temperature under normal operating conditions, but in the absence of a combustible dust layer, not exceeding two-thirds of the minimum ignition temperature in degrees Celsius of the combustible dust/air mixture(s) that can be present and appropriate for any explosive gases encountered ~~not exceeding the auto-ignition temperature of the dust(s) that can be present~~; and
(c) ~~apparatus~~ equipment of a type which ensures absence of sparks or arcs and hot spots during normal operation.

~~4.3.4~~ 4.4.4 Where equipment certified for combustible dusts is not available, consideration will be given to the use of ~~apparatus~~ equipment complying, as a minimum, with the following requirements provided no explosive gases will be present:
(a) the enclosure is to be at least dust protected (IP5X) having, when ~~type~~ tested in accordance with IEC 60529, an ingress of fine dust within the enclosure not exceeding 10 g per m^3 of free air space; and
(b) the surface temperature of the ~~apparatus~~ equipment, under ~~the most onerous combination of~~ normal operating conditions, but in the absence of a combustible dust layer, is not to exceed two-thirds of the minimum ignition temperature in degrees Celsius of the combustible dust/air mixture(s) that can be present; or
(c) the equipment is to be certified intrinsically safe “ia” or “ib” having a temperature classification ensuring compliance with (b); or

(d) pressurised and operated in accordance with procedures ensuring, prior to its re-energisation, the absence of combustible dust within the enclosure following loss of pressurisation and consequent shutdown, and having surface temperature complying with (b); ~~or~~ and

(e) simple apparatus included in intrinsically safe circuits or radio aerials, complying with *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.4~~ 4.3.4*, *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.5~~ 4.3.5* or *Vol 2, Pt 9, Ch 5, ~~4.2~~ 4.3 Selection of equipment for use in explosive gas atmospheres ~~4.2.6~~ 4.3.6* respectively.

~~4.3.5~~ 4.4.5 Consideration may also be given to other types of protection, selected in accordance with the requirements of:

(a) IEC 60079-14: *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*, or

(b) arrangements complying with IEC 60092-506: *Electrical installation in ships – Part 506: Special features: Ships carrying specific dangerous goods and materials hazardous only in bulk*.

~~4.4~~ 4.5 Installation of electrical equipment

~~4.4.1 The method of installation and application of electrical equipment suitable for use in explosive gas atmospheres or in the presence of combustible dusts is to be in accordance with IEC 60079-14:~~ ~~*Explosive atmospheres – Part 14: Electrical installations design, selection and erection*~~~~, or the National Code of Practice relevant to the Standard with which the equipment complies. The ambient temperature range for which the apparatus is certified is to be taken to be –20°C to 40°C, unless otherwise stated, and account is to be taken of this when assessing the suitability of the equipment for the auto-ignition temperature of the gases and dusts encountered. Any special requirements laid down by the equipment certification documentation are also to be observed.~~

~~4.4.2 All switches and protective devices from which equipment located in hazardous zones or spaces is supplied are to interrupt all poles or phases and, where practicable, are to be located in a non-hazardous zone or space. Such equipment, switches and protective devices are to be suitably labelled for identification purposes.~~

4.5.1 The method of installation and application of electrical equipment suitable for use in explosive gas atmospheres or in the presence of combustible dusts is to be in accordance with:

(a) IEC 60079-14: *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*, or

(b) the National code of practice relevant to the standard with which the equipment complies.

4.5.2 The ambient temperature range for which the equipment is certified is to be taken to be –20°C to 40°C, unless otherwise stated, and account is to be taken of this when assessing the suitability of the equipment for the auto-ignition temperature of the gases and combustible dusts encountered.

4.5.3 Any special requirements laid down by the equipment certification documentation are also to be observed.

4.5.4 All switches and protective devices from which electrical equipment located in hazardous areas is supplied are to be located in non-hazardous areas. Where it is not practicable to locate the switches and protective devices in non-hazardous area then the applicable requirements of this section are to be applied to that equipment.

4.5.5 All switches and protective devices from which electrical equipment located in hazardous areas is supplied are to interrupt all poles or phases and protected against unauthorised re-connection.

4.5.6 Electrical equipment in hazardous areas, switches and protective devices are to be clearly labelled for identification purposes.

~~4.5 Hazardous zones and spaces~~

~~4.5.1 For hazardous zones or spaces and sources of hazard for naval ships, the following principles are to apply in general.~~

~~4.5.2 Hazardous areas associated with flammable liquids or gases are classified into zones based upon the frequency of the occurrence and duration of an explosive gas atmosphere, as follows:~~

~~• **zone 0**: place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently;~~

~~• **zone 1**: place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally;~~

~~• **zone 2**: place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.~~

~~*See* IEC 60079-101-1: *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres.*~~

~~4.5.3 Hazardous areas associated with solid substances or packaged liquids are classified into zones based upon the frequency of the occurrence and duration of an explosive atmosphere due to the presence of gas and/or dust, as follows:~~

~~• **hazardous area**: area in which an explosive atmosphere is likely to occur in normal operation (comparable with **zone 1**)~~

~~• **extended hazardous area**: area in which an explosive atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only (comparable with **zone 2**).~~

~~*See* IEC 60079-10-2:*Explosive atmospheres-Part 10-2: Classification of areas – Combustible dust atmospheres, or IEC 60092-506: Electrical Installation in ships-Part 506 – Special features – Ships carrying specific dangerous goods and materials hazardous only in bulk*. An explosive atmosphere may exist due to gas and/or dust.~~

~~4.5.4 A hazardous zone or space may arise from the presence of any of the following:~~

~~(a) spaces or tanks containing either:~~
  ~~(i) flammable liquid having a flashpoint (closed-cup test) not exceeding 60°C;~~
  ~~(ii) flammable liquid having a flashpoint exceeding 60°C, heated or raised by ambient conditions to a temperature within 15°C of its flashpoint; or~~
  ~~(iii) flammable gas;~~
~~(b) piping systems or equipment containing fluid defined by (a) and having flanged joints or glands or other openings through which leakage of fluid may occur under normal operating conditions;~~
~~(c) spaces containing solids, such as coal or grain, liable to release flammable gas and/or combustible dust;~~
~~(d) spaces containing dangerous goods in packaged form, of the following Classes as defined in the IMDG Code: 1 (with the exception of goods in division 1.4, compatibility group S), 2.1 (inclusive of applicable gas bottles for on board use), 3, 6.1 and 8;~~
~~(e) piping systems or equipment associated with processes (such as electrochlorination) generating flammable gas as a by-product and having openings from which the gas may escape under normal operating conditions; or~~
~~(f) piping systems or equivalent containing flammable liquids not defined by (a), having flanged joints, glands or other openings through which leakage of fluid in the form of a mist or fine spray may occur under normal operating conditions.~~

~~4.5.5 The following zones or spaces are regarded as hazardous, **zone 0**:~~

~~(a) the interiors of those spaces, tanks, piping systems and equipment defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4* and *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*; and~~
~~(b) enclosed, unventilated spaces containing pipework or equipment defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4* and *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*.~~

~~4.5.6 The following zones or spaces are regarded as hazardous, **zone 1**:~~

~~(a) the interiors of spaces containing dangerous goods as defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*;~~
~~(b) unventilated spaces separated by a single bulkhead or deck from a cargo defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*;~~
~~(c) ventilated spaces containing pipework or equipment defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4* and *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*;~~
~~(d) zones within a 1,5 m radius of ventilation outlets, hatches or doorways or other openings into spaces defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*, *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* or *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*, or within 1,5 m of the ventilation outlets of spaces regarded by *Vol 2, Pt 9, Ch 5, 4.7 Ventilation* as open areas and which contain the pipework or equipment defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4* or *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*. Where the hazard results from flammable gas or vapour having a density relative to that of air of more than 0,75 m, the hazardous zone is considered to extend vertically downward to solid deck, or for a distance of 9 m, whichever is the lesser;~~
~~(e) zones within a 1,5 m radius of flanged joints, or glands or other openings defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*; in the case of gas or vapour having a relative density of more than 0,75 m, the hazardous zone is considered to extend vertically downwards as described under *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*;~~
~~(f) zones within a 1,5 m radius of flanged joints, or glands or other openings defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4* and *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*;~~
~~(g) zones within a 1,5 m radius of bunds or barriers intended to contain spillage of liquids defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*;~~
~~(h) zones on open deck within a 1,5 m radius of any opening into a space defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* or *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*; and~~
~~(i) enclosed or semi-enclosed spaces with direct opening into a **zone 1** hazardous location.~~

~~4.5.7 The following zones or spaces are regarded as hazardous, **zone 2**:~~

~~(a) ventilated spaces separated by a single bulkhead or deck from a **zone 0** space;~~
~~(b) zones on open deck extending 1,5 m beyond those defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*, *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*, *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*, *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* or *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*;~~
~~(c) zones within a 1,5 m radius of ventilation inlets serving spaces defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* or *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*; and~~
~~(d) enclosed or semi-enclosed spaces with direct opening into a **zone 2** hazardous location.~~

4.6 Semi-enclosed spaces

4.6.1 Semi-enclosed spaces are considered to be spaces limited by decks and/or bulkheads in such a manner that the natural conditions of ventilation are ~~sensibly~~ different from those obtained on open deck.

4.7 Ventilation

4.7.1 ~~Where an enclosed or semi-enclosed space is provided with mechanical ventilation ensuring at least 12 air changes/ hour, and leaving no areas of stagnant air, it may be regarded in consideration of hazardous zones as would otherwise be defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.5*, *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* or *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* and *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.7*, as an open area.~~ Natural or mechanical ventilation is to be provided for hazardous enclosed or semi-enclosed spaces in order to prevent accumulation of explosive gas atmosphere, leaving no areas of stagnant air. Ventilation rates are to be calculated based on IEC 60079-10-1: *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*.

4.8 Pressurisation

4.8.1 A space having access to a hazardous ~~space or zone~~ area defined as **zone 1** or **zone 2** may be regarded as non-hazardous if ~~fulfilling all the following conditions~~ all the following requirements are met:

(a) access is by means of an air-lock, having gastight steel doors, the inner of which, as a minimum, is self-closing without any hold-back arrangement;

(b) ~~it is~~ a space and an air-lock are maintained at an overpressure (minimum 0,25 mbar) relative to the external hazardous area by ventilation from a non-hazardous area;

(c) ~~the relative air pressure within the space is continuously monitored and so arranged that, in the event of loss of overpressure, an alarm is given and the electrical supply to all equipment not of a type suitable for zone 1 is automatically disconnected. Where the shutdown of equipment could introduce a hazard, an alarm may be given, in lieu of shutdown, upon loss of overpressure, and a means of disconnection of electrical equipment not of a type suitable for **zone 1**, capable of being controlled from an attended station, provided in conjunction with an agreed operational procedure; where the means of disconnection is located within the space then it is to be effected by equipment of a type suitable for **zone 1**;~~
the relative air pressure within the space is continuously monitored and so arranged that:
   (i) in the event of loss of overpressure, an alarm is given;
   (ii) the electrical supply to all equipment not of a type suitable for **zone 1** is automatically disconnected;
   (iii) where the disconnection of equipment could introduce a hazard, an alarm may be given, in lieu of automatic shutdown, upon loss of overpressure; and
   (iv) a means of manual disconnection of electrical equipment not of a type suitable for **zone 1**, capable of being controlled from an attended station, is to be provided in conjunction with an agreed operational procedure; and
   (v) where the means of disconnection, capable of being controlled from an attended station, is located within the space then it is to be of a type suitable for **zone 1**;

(d) any electrical equipment required to operate upon loss of overpressure, lighting fittings (*see Vol 2, Pt 9, Ch 6, 4.3 Lighting circuits 4.3.3*) and equipment within the air-lock, is to be of a type suitable for **zone 1**; and

(e) means are to be provided to prevent electrical equipment, other than of a type suitable for **zone 1**, being energised until the atmosphere within the space is made safe, by air changes ~~renewal~~ of at least 10 times the capacity of the space.

4.8.2 A space having access to a hazardous space or zone defined as **zone 2** may be regarded as non-hazardous if ~~fulfilling all the following conditions~~ all following requirements are met:

(a) access is by means of a self-closing gastight steel door without any hold-back arrangement;

(b) it is maintained at an overpressure (minimum 0,25 mbar), relative to the external hazardous area by ventilation from a non-hazardous area;

(c) ~~the relative air pressure within the space is continuously monitored and so arranged that, in the event of loss of overpressure, an alarm is given. A means of disconnection of electrical equipment not of a type suitable for **zone 2** is to be provided; where the means of disconnection is located within the space then it is to be effected by equipment of a type suitable for **zone 2**;~~
the relative air pressure within the space is continuously monitored and so arranged that:
   (i) in the event of loss of overpressure, an alarm is given; and
   (ii) a means of manual disconnection of electrical equipment not of a type suitable for **zone 2**, capable of being controlled from an attended station, is to be provided; where the means of disconnection, capable of being controlled from an attended station, is located within the space then it is to be of a type suitable for **zone 2**;

(d) any electrical equipment required to operate upon loss of overpressure (e.g. lighting fittings, *see Vol 2, Pt 9, Ch 7, 4.7 Valve control and indication systems 4.7.3*), is to be of a type suitable for **zone 2**; and

(e) means are to be provided to prevent electrical equipment, other than of a type suitable for **zone 2**, being energised until the atmosphere within the space is made safe, by air changes of at least 10 times the capacity of the space.

4.9 Cable and cable installation

4.9.1 Electric cables are not, as far as is practicable, to be installed in hazardous ~~zones or spaces~~ areas, except where serving equipment installed within the ~~zone or space~~ area. Through runs of cable may be accepted in locations classified as **zone 1** or **zone 2**, where alternative routes are impracticable. Electric cables in hazardous areas are to be clearly labelled for identification purposes.

4.9.2 In addition to the requirements of ~~*Vol 2, Pt 9, Ch 3, 8 Electric cables, optical fibre cables and busbar trunking systems (busways)*,~~ *Vol 2, Pt 9, Ch 3, 8 Electric cables, optical fibre cables and busbar trunking systems(busways)*, cables for circuits that are not intrinsically safe, which are located in hazardous ~~zones or spaces~~ areas, or which may be exposed to cargo oil, oil vapour or gas, are to be either:

~~(a) mineral insulated with copper sheath; or~~
(~~b~~a) armoured or braided for earth detection; or
(~~c~~b) otherwise adequately protected against mechanical or chemical damage, within **zone 2** or non-hazardous ~~locations~~ areas only; or
(~~d~~c) as otherwise specifically permitted elsewhere within this Section; or
(d) mineral insulated with copper sheath.

4.9.3 Armouring, braiding and other metal coverings of cables installed in hazardous areas ~~dangerous zones or spaces~~ are to be effectively earthed at least at both ends, *see Vol 2, Pt 9, Ch 1, 2.4 Earthing and bonding 2.4.4*.

4.9.7 Cable runs in **zone 1** or **zone 2** are, where practicable, to be uninterrupted. Where discontinuities cannot be avoided, cable joints are~~, additionally,~~ to:

- be made in an enclosure with a type of protection appropriate to the location; or
- provided the joint is not subject to mechanical stress, be epoxy filled, compound filled or sleeved with heat-shrunk tubing, in accordance with the manufacturer's instructions.

4.10 Requirements for oil supply ships intended for the carriage ~~in bulk~~ of oil cargoes in bulk ~~having a flash point not exceeding 60°C (closed-cup test)~~

4.10.1 ~~In order to eliminate potential sources of ignition from hazardous areas on board Oil Supply Ships electrical equipment is to be selected and installed in accordance with IEC 60092: *Electrical installations in ships – Part 502: Tankers – Special features*.~~ *See* IEC 60092: *Electrical installations in ships – Part 502: Tankers – Special features*.

~~4.10.2 The relevant group and temperature class for electrical equipment in hazardous zones are, respectively, IIA and T3.~~

~~4.10.3 Further to the requirements of paragraph *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6*, open deck, or semi-enclosed spaces on open deck, within 3 m of the ventilation outlets of tanks defined in *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.4*, which permit the flow of small volumes of vapour or gas mixtures caused by thermal variation are to be regarded as hazardous **zone 1.**~~

~~4.10.4 Further to the requirements of paragraph *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.7*, open deck extending 2 m beyond those defined by *Vol 2, Pt 9, Ch 5, 4.5 Hazardous zones and spaces 4.5.6* are to be regarded as hazardous **zone 2**.~~

4.11 Special requirements for ships with spaces for carrying vehicles, helicopters and aircraft, with fuel in their tanks

4.11.1 Ships with closed spaces carrying vehicles, helicopter and aircraft with fuel having a flashpoint not exceeding 60ºC:

(a) except where exempted by (b) electrical equipment fitted within the space and within the exhaust ventilation trunking for the space is to be of a type acceptable for **zone 1**;

(b) where the ventilation system required by the Naval Administration is arranged to operate continuously and is sufficient to provide at least ten air changes per hour, whenever vehicles are on board, above a height of 45 cm from the vehicle deck, or any platform on which vehicles are carried, electrical equipment having an enclosure of ingress protection rating of at least IP 55 may be accepted as an alternative to that of a safe type~~;~~.

~~(c) all electrical circuits terminating in the space are to be provided with multi-pole linked isolating switches located outside the space concerned. Provision is to be made for locking in the off position. This does not apply to safety circuits such as those for fire, smoke or gas detection.~~

4.12 Special requirements for ships intended for the carriage of dangerous goods and materials hazardous only in bulk

4.12.1 Electrical equipment essential for the safety and operation of the ship is to be of a type providing protection against ignition of the gases and/or combustible dusts that can be present, selected in accordance with IEC 60092-506: *Electrical installations in ships – Part 506: Special features – Ships carrying specific dangerous goods and materials hazardous only in bulk*.

4.12.2 In addition to the requirements of IEC 60092-506: *Electrical installations in ships – Part 506: Special features – Ships carrying specific dangerous goods and materials hazardous only in bulk*, pipes such as ventilation and bilge pipes having ends opening into a **hazardous area** are to be considered a **hazardous area**. Enclosed spaces such as pipe tunnels and bilge pump-rooms containing such pipes and with equipment and components such as pumps, valves and flanges are to be considered as **extended hazardous areas** unless protected by overpressure.

4.12.3 Electrical equipment not essential for the safety or operation of the ship and which is not of a type providing protection against ignition of the gases and/or combustible dusts that can be present is to be completely disconnected and protected against unauthorised re-connection. Disconnection is to be made outside the hazardous areas and be effected with isolating links or lockable switches.

4.12.4 Electrical equipment and all cables, including through runs and terminating cables, are to be protected against mechanical damage. Cables are to be either enclosed in screwed heavy gauge steel drawn or seam-welded and galvanised conduit, or protected by electrically continuous metal sheathing or metallic wire armour braid or tape.

4.12.5 Cable penetrations of decks and bulkheads are to be sealed against the passage of gas or vapour.

4.13 Requirements for ships with spaces for storing paint

4.13.1 In order to eliminate potential sources of ignition in paint stores, electrical equipment is to be selected as follows:

(a) electrical equipment fitted within the space and within the exhaust ventilation trunking for the space is to be of a type acceptable for **zone 1**;

(b) electrical equipment situated within 1 m of inlet and exhaust ventilation openings or within 3 m of exhaust mechanical ventilation outlets is to be of a type acceptable for **zone 2**, or is to have an enclosure of ingress protection rating of at least IP55 and maximum surface temperature equivalent to temperature class T3, *see* IEC 60529, *Classification of Degrees of Protection Provided by Enclosures*.

4.13.2 A space having access to a paint store may be regarded as non-hazardous if all following requirements are met:

(a) access is by means of a self-closing gastight steel door without any hold-back arrangement;
(b) the paint store is ventilated from a non-hazardous area; and
(c) warning notices are fitted adjacent to the paint store entrance warning of flammable liquids contained in paint store.

Note A watertight door may be considered as being gastight.

4.13.3 The relevant group and temperature class for electrical equipment in hazardous zones are, respectively, IIB and T3.

© Lloyd’s Register Group Limited 2017
Published by Lloyd’s Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom

Lloyd’s Register and variants of it are trading names of Lloyd’s Register Group Limited, its subsidiaries and affiliates. For further details please see http://www.lr.org/entities

Lloyd's Register Group Limited, its subsidiaries and affiliates and their respective officers, employees or agents are, individually and collectively, referred to in this clause as ‘Lloyd's Register’. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.